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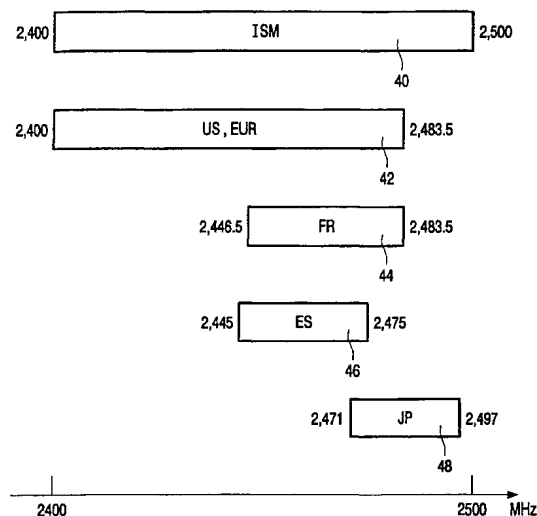
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: A SHORT RANGE, LOW POWER COMMUNICATIONS SYSTEM AND A METHOD OF OPERATING THE SYSTEM



(57) Abstract: A short range, low power communications system comprises a plurality of transceiving stations (RCM 1 TO RCM 4) capable of communicating in the ISM band, wherein a station wishing to transmit a data packet, transmits the data packet as a low bit rate, direct sequence spread spectrum (DSSS) signal in a spectrum allocation which is common to at least one geographical region and/or a plurality of countries. A carrier sense multiple access (CSMA) protocol may be used to enable the stations to access said spectrum allocation.



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## DESCRIPTION

**A SHORT RANGE, LOW POWER COMMUNICATIONS SYSTEM AND  
A METHOD OF OPERATING THE SYSTEM**

## 5 Technical Field

The present invention relates to a short range(typically up to 50m), low power (10mW) communications system having particular, but not exclusive, application to domestic radio control systems, for example operating domestic appliances and fitments using a radio remote control, and short range  
10 interactivity, for example playing games and operating toys and to a method of operating the system.

## Background Art

In many regions and countries of the world the so-called ISM band around 2.4 GHz is available for short range communications. Generally known  
15 systems operating in the ISM band are Direct Sequence Spread Spectrum(DSSS) systems and Frequency Hopping Spread Spectrum systems. DSSS systems are usually used for high bit rate systems offering 11Mb/s and Frequency Hopping systems usually offer 1 Mb/s. However there are differences in regulations and requirements between regions and countries  
20 which have the effects that products have to be made or set-up specifically for certain regions and countries with the consequence that distribution has to be closely supervised and also that products are not usable universally, sometimes not even in neighbouring countries in the same region which irritates users.

## 25 Disclosure of Invention

An object of the present invention is to provide a communication system for domestic and interactive applications which is applicable universally.

According to one aspect of the present invention there is a method of operating a short range, low power communications system comprising a  
30 plurality of transceiving stations capable of communicating in the ISM band, wherein a station wishing to transmit a data packet, transmits the data packet as a low bit rate, direct sequence spread spectrum signal in a spectrum allocation

which is common to at least one geographical region and/or a plurality of countries.

According to a second aspect of the present invention there is provided a short range, low power communications system comprising a plurality of transceiving stations communicating on at least one channel in the ISM band, wherein a station comprises means for transmitting a data packet as a low bit rate, direct sequence spread spectrum signal in a spectrum allocation which is common to at least one geographical region and/or a plurality of countries.

The second aspect of the present invention also provides a short range, low power communications system comprising a plurality of transceiving stations communicating on at least one channel in the ISM band, one of said stations having the role of a central controller, wherein each said station has means responsive to a transmit request for transmitting a data packet as a low bit rate, direct sequence spread spectrum signal in a spectrum allocation which is common to at least one geographical region and/or a plurality of countries.

The system in accordance with the present invention does not have a requirement to occupy the whole ISM band from 2.4 to 2.5 GHz so that the frequency or frequencies of operation can be chosen at will. For the widest possible usage the frequency allocation is selected to be in a part of the ISM band which is common to many if not all countries, for example 2,446.5 to 2,475.0 MHz. By using a modest data rate and DSSS with a limited spreading factor the spread signal can readily fit within the said frequency allocations. Additionally by using DSSS one obtains robustness in transmission and coding gains.

In an embodiment of the method and system in accordance with the present invention the transmitting station applies a carrier sense multiple access (CSMA) protocol to access said spectrum allocation.

By operating a system made in accordance with the present invention one obtains the potential benefits of:

1. A wider sale of products without regional variation thus leading to simplifying design, logistics, application and installation, and reducing cost.

2. Mobility of use of equipment with no need to reconfigure all the radio links when travelling between or through countries to comply with their respective different regulations.

3. A possible commonly available short range communication  
5 channel which is not only useful in its own right but also can be used to set up further specific links (which may differ from region to region) to run, for example, higher bandwidth applications in a manner consistent with local regulations.

#### Brief Description of Drawings

10 The present invention will now be described, by way of example, with reference to the accompanying drawings, wherein:

Figure 1 is a block schematic diagram of a radio Local Area Network (LAN), and

15 Figure 2 is a diagram showing the ISM frequency band and several allocated spectrums.

#### Modes for Carrying Out the Invention

The radio LAN shown in Figure 1 comprises a number of operating devices OD1, OD2, OD3 and OD4 and a radio remote controller RC. For convenience of illustration the operating devices OD1 to OD4 respectively  
20 comprise a TV set, a set top box STB, a video cassette recorder VCR and a personal computer PC. The operating devices OD1 to OD4 further comprise a radio control module RCM1 to RCM4, respectively, which enable the operating devices to be members of the radio LAN which is controllable by a user operating the radio remote controller RC.

25 The radio remote controller RC comprises a microcontroller 10, a keypad 12 constituting a man/machine (MMI) interface coupled to the microcontroller 10 and an radio transceiver 14 coupled to the microcontroller 10. The output power of the transmitter section of the transceiver 14 is of the order of 10mW which gives a typical line of sight range of 50m.

30 Each of the radio control modules RCM1 to RCM4 is substantially identical and in the interests of brevity only radio control module RCM1 will be described in detail. An antenna (or other radio signal propagation means) 20 is

coupled to a radio transceiver 22 capable of transmitting and receiving DSSS signals on one or more narrowband channels in the ISM band. A microcontroller 24 has inputs/outputs coupled to a program ROM 26, a store 28 for storing a spreading code, and a store 30 for storing the data packet.

5       The transmission of digital data packets between pairs of the operating devices OD1 to OD4 is as a low power, low bit rate, single channel DSSS signals. Access to the channel is by a Carrier Sense Multiple Access (CSMA) protocol in which the radio control module wanting to transmit listens to the radio channel to ascertain if there is any activity on the radio channel and if it is  
10       free the radio control module switches to transmit and sends its data packet.

For flexibility in operation, the radio LAN does not have a separate central controller but at least some of radio control modules of the operating devices OD1 to OD4 are capable of acting as a central controller CC. For convenience of reference these operating devices are called master capable  
15       operating devices. By way of illustration, it will be assumed that the radio control module RCM2 is functioning as the central controller CC. If a user with the radio remote controller RC wants the TV set to be operatively connected to the VCR, he/she selects VCR on the remote controller RC, accesses the channel and a DSSS signal S1 is sent by the transmitter to the transceiver 22  
20       in the remote control module RCM2 functioning as the central controller. The central controller checks to see if the channel is free and assuming that it is the transceiver transmits DSSS link establishing signals S2 to both the operating devices OD1 and OD3. The radio control modules RCM1 and RCM3 establish a wideband data exchange link WL between them thus enabling the video and  
25       sound data from the VCR to be reproduced on the TV set.

The selection of the radio channel or channels for use by the communications system made in accordance with the present invention is determined by considering the current spectrum allocations in the ISM band.

Figure 2 shows the ISM band referenced 40 and the spectrum  
30       allocations for the USA and Europe (EUR) referenced 42, for France (FR) referenced 44, for Spain (ES) referenced 46 and for Japan (JP) referenced 48. Ignoring the Japanese allocation 48, it will be seen that there is sufficient

overlap between the other allocations 42, 44 and 46 to achieve several common channels, each of 3.3 MHz. As the Japanese allocation 48 is in the process of being extended downwards, sufficient common capacity will be provided by the allocations 42, 44 and 46 together with the notionally extended allocation 48 to enable similarly specified products to be able to operate in the USA, Europe, France, Spain and Japan. Even with the regulatory situation as exists at present it is possible to fit a channel between 2,471 MHz and 2,475 MHz the area of overlap between the bottom end of the Japanese allocation 48 and the top end of the Spanish allocation 46.

Ideally to reduce interference with microwave ovens, it is beneficial for any critical services and applications to use the lower part of the frequency sub-band.

A tabular summary of a proposal for the key parameters of a narrowband DSSS radio communication system for use in the ISM band is set out below. Transmissions on a channel may be initiated in accordance with a CSMA protocol.

Parameter	Value	Comment
Frequency Band	2.4475-2.4735 GHz (26MHz bandwidth)	Uses the common frequencies allocated to ISM band in USA, (Japan) and Europe.
Spread Spectrum type	Direct Sequence	Complexity moved into the digital domain, allows fast synchronisation, and uses just part of the 2.4 GHz band.
Frequency Channels	6 channels spaced by 4 MHz	One channel allocated for network registration purposes.
Chip Rate	2.2 Mchips/s	Bandwidth of main lobe of transmitter 3.3 MHz.
Spreading Code	11 Barker Sequence	
Modulation	GFSK, modulation index 0.5	Constant envelope.
Gross Bit Rate supported	200 kb/s.	

By having several frequency channels it is possible to allocate respective channels for predetermined tasks such as registration and setting up communication channels between operating devices.

In the present specification and claims the word "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. Further, the word "comprising" does not exclude the presence of other elements or steps than those listed.

From reading the present disclosure, other modifications will be apparent to persons skilled in the art. Such modifications may involve other features which are already known in the design, manufacture and use of low power, short range, communications systems and component parts therefor and which may be used instead of or in addition to features already described herein.

#### Industrial Applicability

Short range (typically up to 50m), low power (10mW) communications systems suitable for application to domestic radio control systems.

## CLAIMS

1. A method of operating a short range, low power communications  
5 system comprising a plurality of transceiving stations capable of communicating  
in the ISM band, wherein a station wishing to transmit a data packet, transmits  
the data packet as a low bit rate, direct sequence spread spectrum signal in a  
spectrum allocation which is common to at least one geographical region and/or  
a plurality of countries.

10

2. A method as claimed in claim 1, characterised in that the  
transmitting station applies a carrier sense multiple access (CSMA) protocol to  
access said spectrum allocation.

15

3. A method as claimed in claim 1 or 2, characterised in that said  
spectrum allocation lies in a frequency band between 2,446.5 to 2,475.0 Mhz.

20

4. A method as claimed in claim 1, 2 or 3, characterised in that the  
modulation is Gaussian Frequency Shift Key (GFSK) having a modulation  
index 0.5.

25

5. A method as claimed in any one of claims 1 to 4, characterised in  
that the chip rate is 2.2 Mchips/s and the spreading code is an 11 chip Barker  
sequence.

30

6. A method as claimed in any one of claims 1 to 5, characterised in  
that the spectrum allocation comprises a plurality of channels, at least one of  
which channels is allocated for registration purposes.

7. A method as claimed in any one of claims 1 to 5, characterised in  
that that the spectrum allocation comprises a plurality of channels, at least one

of which channels is allocated for setting up communication channels between transceiving stations.

8. A short range, low power communications system comprising a plurality of transceiving stations communicating on at least one channel in the ISM band, wherein a station comprises means for transmitting a data packet as a low bit rate, direct sequence spread spectrum signal in a spectrum allocation which is common to at least one geographical region and/or a plurality of countries.

9. A short range, low power communications system comprising a plurality of transceiving stations communicating on at least one channel in the ISM band, one of said stations having the role of a central controller, wherein each said station has means responsive to a transmit request for transmitting a data packet as a low bit rate, direct sequence spread spectrum signal in a spectrum allocation which is common to at least one geographical region and/or a plurality of countries.

10. A communications system as claimed in claim 8 or 9, characterised in that each of the transceiving stations has means responsive to a transmit request for effecting a carrier sense multiple access (CSMA) protocol to access said frequency spectrum.

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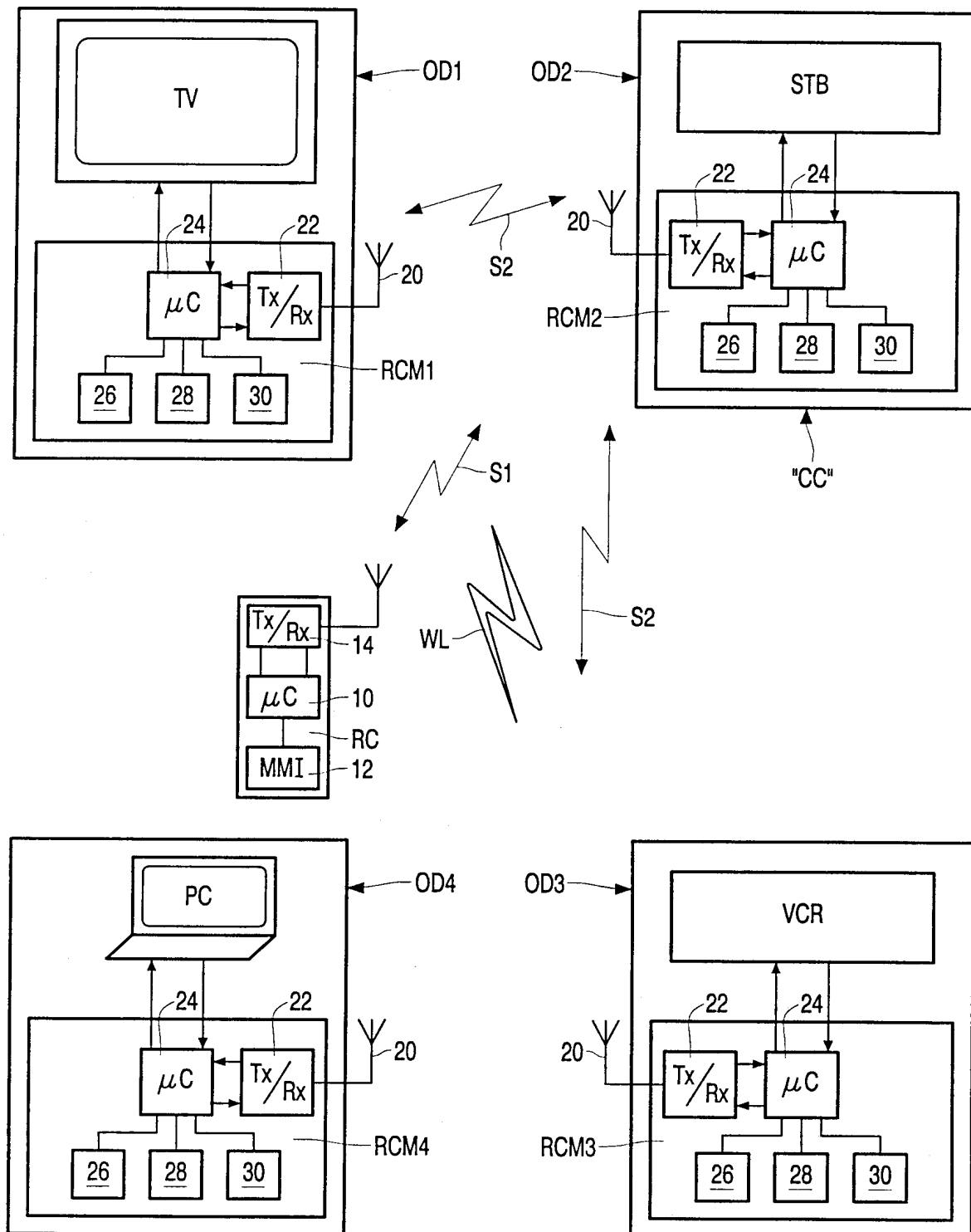


FIG. 1

2/2

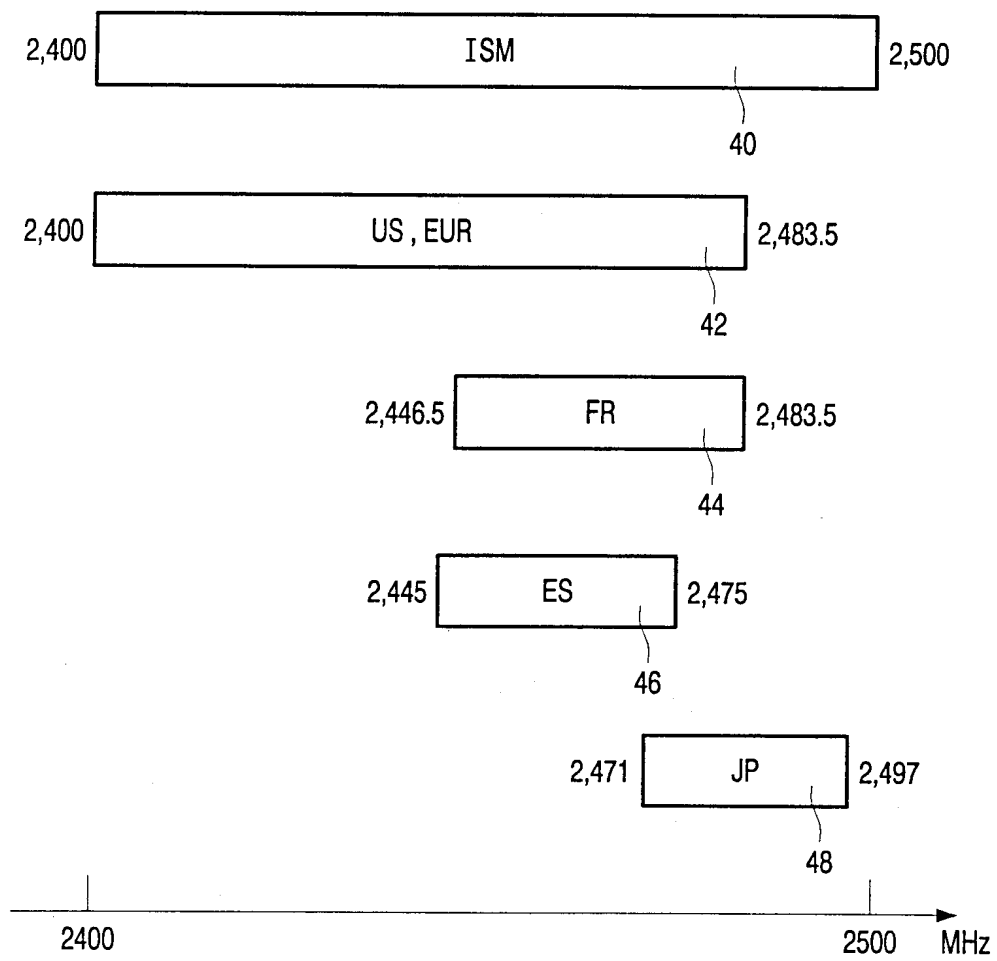


FIG. 2

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 00/10439

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04L12/28

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>KAMERMAN A ET AL: "WAVELAN-II: A HIGH-PERFORMANCE WIRELESS LAN FOR THE UNLICENSED BAND"</p> <p>BELL LABS TECHNICAL JOURNAL, US, BELL LABORATORIES,</p> <p>vol. 2, no. 3, 21 June 1997 (1997-06-21), pages 118-133, XP000703744</p> <p>ISSN: 1089-7089</p> <p>* page 119, left-hand column, line 12 - right-hand column, line 7 *</p> <p>* page 120, right-hand column, line 21 - page 123, left-hand column, line 21 *</p> <p>-----</p>	1-10

☐ Further documents are listed in the continuation of box C.

☐ Patent family members are listed in annex.

## \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
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